CLAIMS

What is claimed is:

1. A tool for placing preformed solder balls on a substrate, comprising:

a tool body controllably movable in multiple axes and rotatable about an axis;

a plurality of ball seats formed in said body for said preformed solder balls, said plurality of ball seats each having an aperture therein;

a passageway leading from said aperture to a vacuum source and to a pressurized gas source;

valve apparatus for controlling separately and independently a vacuum and a gas under pressure to said ball seats, said vacuum retaining said solder balls on said ball seats, and said pressurized gas releasing said solder balls from said ball seats.

2. The pickup tool of claim 1, wherein said vacuum holds said solder balls in said ball seats and said pressurized gas ejects said solder balls from said ball seats.

3. The pickup tool of claim 1, wherein said vacuum holds said solder balls in said ball seats and said pressurized gas ejects said solder balls from said ball seats to a plurality of bond pads on said substrate.

4. The pickup tool of claim 1, further comprising:

a controllable ball dispenser supplying solder balls to said pickup tool, comprising:

a ramp for feeding solder balls to said ball seats, said ramp having an upper end and a lower end;

a controllable valve at the lower end of said ramp for releasing a single solder ball of said solder balls on demand to said ball seats using a vacuum applied to said ball seats; and

a reservoir providing a supply of solder balls to said ramp.

5. The pickup tool of claim 4, further comprising:

a gas inlet in said reservoir, said gas inlet connected to a source of pressurized gas for providing gas flow through said solder balls to provide a non-interrupted flow of said solder balls through said ramp.

6. The pickup tool of claim 4, wherein said ramp holds a series of solder balls having a diameter in the range of about 0.01 mm to about 0.15 mm.

7. The pickup tool of claim 1, further comprising:

a screen having a plurality of apertures therein, an aperture of said plurality of apertures located adjacent an aperture of said ball seats formed in said body for said solder balls.

8. A pickup tool for placing a plurality of solder balls on ball-grid-array bond pads of a substrate, said pickup tool comprising:

a pickup tool body with a hollow chamber therein;

a lower plate having a plurality of seats therein for retaining a solder ball in each seat, said plurality of seats corresponding to an inverted configuration of an array of bond pads on a substrate;

a plurality of passageways leading from each said seat to said hollow chamber;

a passageway leading from said chamber to a vacuum source;

a passageway leading from said chamber to a pressurized gas; and

controllable valve apparatus for controlling opening and closing said vacuum passageway and pressurized gas.

9. The pickup tool of claim 8, further comprising:

a heater to heat said pickup to a temperature to bond said solder balls bond to said bond pads of said substrate.

15. A pickup tool for placing a plurality of solder balls on ball-grid-array bond pads of a substrate, said pickup tool comprising:

a pickup tool body with a hollow chamber therein;

a lower plate having a plurality of seats therein for attracting and retaining a solder ball in each seat, said plurality of seats corresponding to an inverted array of bond pads on a substrate;

passageways leading from each said seat of said plurality of seats to said hollow chamber;

a passageway leading from said chamber to a vacuum source;

a passageway leading from said chamber to a pressurized gas; and

controllable valve apparatus controllably said vacuum and pressurized gas.

16. The pickup tool of claim 15, further comprising:

a heater to heat said solder balls to a temperature to bond to said bond pads on said substrate.

10. A pickup tool for placing preformed solder balls on a substrate, comprising:

a tool body controllably movable in multiple axes and rotatable about an axis;

a plurality of ball seats formed in said tool body for a plurality of solder balls, each ball seat of said plurality of ball seats having an aperture therein;

a passageway leading from said aperture to a vacuum source and to a pressurized gas; and

controllable valve apparatus controlling the vacuum and the pressurized gas to said ball seat, said vacuum retaining said solder ball in each said ball seat and said pressurized gas releasing solder ball from said ball seat.

11. The pickup tool of claim 10, wherein said vacuum holds said solder ball in said ball seat and said pressurized gas ejects said solder ball from said ball seat to a bond pad on a substrate.

12. The pickup tool of claim 10, further comprising:

a solder ball dispenser supplying solder balls to said pickup tool, comprising:

a tubular ramp for feeding solder balls to said ball seat, said ramp having an upper end and a lower end;

a controllable valve at the lower end of said ramp for releasing a single solder ball to said ball seat while a vacuum is applied to said ball seat;

a reservoir for providing a supply of solder balls to move downwardly through said ramp.

13. The pickup tool of claim 12, further comprising:

a gas inlet in said reservoir, said gas inlet connected to said pressurized gas providing gas flow through said solder balls providing a non-interrupted flow of solder balls through said ramp.

14. The pickup tool of claim 12, wherein said ramp holds solder balls having a diameter of about 0.01 mm to about 0.15 mm.